CLASSIFICATION CONFIDENTIAL **CONFIDENTIAL**

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT [redacted]
CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1948
SUBJECT	Scientific - Metals	DATE DIST.	25 Aug 1950
HOW PUBLISHED	Book		
WHERE PUBLISHED	Moscow	NO. OF PAGES	6
DATE PUBLISHED	1948	SUPPLEMENT TO REPORT NO.	
LANGUAGE	Russian		

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF ESPIONAGE ACT 50 U. S. C., 31 AND 32, AS AMENDED. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW. REPRODUCTION OF THIS FORM IS PROHIBITED.

THIS IS UNEVALUATED INFORMATION

SOURCE Poroshkovoye metallovedeniye, Metallurgizdat, [redacted]

50X1-HUM

TABLE OF CONTENTS FOR "POWDER METALLOGRAPHY"

M. Yu. Bal'shin

Table of Contents

Page

Introduction

I.

1. Powder Metallography, its place among other branches of science, and its problems 7
2. Contact surface 10

II. Study of contact phenomena in application to compact bodies

3. Surface state of compact metals 11
4. Study of a contact surface 16
5. Interatomic forces. Surface forces of cohesion. Equilibrium between external and intermolecular forces 19
6. Deformation of the contact surface. Relation between the contact area and pressure 23
7. Mechanism of forming a contact surface 29
8. Work of forming a contact surface 32

CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

STATE	☒	NAVY	☒	NSRB	DISTRIBUTION
ARMY	☒	AIR	☒	FBI	

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

Page

9. Changes in the area of a contact surface at unloading. Elastic after effect 33

10. Contact strength 38

11. Shifting of the contact surface during sliding 43

III. Metal powders

12. Fundamental information on structural elements of metal powders 46

13. Condition of the loose material under action of its own weight 55

14. Various methods for expressing the volume characteristic of porous bodies 62

IV. Cold deformation of metal powders

15. General information 65

16. Maximum stresses and minimum sections in powder bodies. Relation between the contact surface and pressure 68

17. Changes in the structure and state of powders caused by pressing 70

18. Pressure of pressing 77

19. Relation between "net" pressure and deformation during pressing of the powders 78

20. Real diagrams of pressing: relative volume -- the logarithm of specific pressure 83

21. Further study of semilogarithmic diagrams of pressing 85

22. Dependence of the pressing diagram on the kind of metal and pressing temperature 94

23. Dependence of semilogarithmic pressing diagrams on the volume characteristic and structural factors 99

24. Pressing the mixtures 100

25. Influence of oxides 102

26. Effect of treatment on the pressability of powders 103

27. Other expressions for relation between pressure and the compression degree 105

28. Work of pressing 107

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

CONFIDENTIAL

[redacted]

50X1-HUM

Page

29. Deviation of logarithmic diagrams from the rectilinear 112

30. Effect of lubricators on pressing diagrams 113

V. Distribution of pressure and density in powder materials

31. Lateral pressure 115

32. Pressure loss on friction against walls of a die and ejecting pressure 118

33. Nonuniform density along the height and cross section of compressed parts 121

34. Effect of dimensions of a compressed part on pressing diagrams 123

35. Relation between the lateral pressure and angle of rest in noncompressed powders 126

VI. Phenomena taking place after releasing pressure - Elastic aftereffect

36. Elastic aftereffect 131

37. Changes in the electric conductivity of compressed parts as a result of the elastic aftereffect 134

38. Effect of air 137

VII. Properties of compressed parts 141

39. Electric conductivity of compressed parts 141

40. Porosity of compressed parts 144

41. Initial information on mechanical properties of compressed products 147

42. Modulus of elasticity of compressed products 149

43. Some results of the proportionality between the modulus of elasticity and pressure 153

44. Dependence of the strength of compressed products on pressure and porosity 154

45. Dependence of the strength on properties and condition of metal in a powder 160

46. Effect of impurities and admixtures on the strength of compressed products 163

47. Effect of the volume characteristic and structure of particles on the strength of compressed products 164

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

CONFIDENTIAL

[redacted] 50X1-HUM

Page

48. Effect of the pressing rate 167
49. Causes of rejection 170
50. Hardness of compressed products 171
51. Is there a quality difference between compressed and uncompressed powders 173
52. The cold pressing process from the power viewpoint 175

VIII. Introduction to the sintering theory

53. Mobility of atoms and its changes on heating 178
54. Further information on the atom mobility 184
55. Deformation of compact metals conditioned by atom mobility 190
56. Recovery and recrystallization in compact metals 191
58. Volume changes during annealing of compact metals 198
59. Deformation in heating under action of external forces 199
60. Definition of the term sintering 208
61. Processes occurring in sintering. Increase and decrease of the contact surface. Convergence and divergence of particles 209
62. Increase of a contact surface and contraction as results of the atom mobility 212
63. Amortization of residual stresses 216
64. Unregulated localization of contraction 218
65. Individual modifications of particles 223
66. Thermal expansion and contraction 224
67. Effect of impurities 225
68. Recrystallization 230

X. Effect of sintering conditions

69. Evaluation of the sintering process 237
70. Influence of the sintering temperature on contact, contraction, and properties 239

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

Page

71. Influence of the temperature on structural modifications. Relation between structural modifications and contraction 246
72. Influence of the sintering time period 254
73. Influence of the size, shape, and structure of particles 259
74. Influence of the size and shape of particles on the structure of sintered products 263
75. Influence of the pressing density 265
76. Influence of preliminary treatment of powders 272
77. Influence of metal type and of phase transformations 274
78. Investigation of individual modifications of particles in sintering 275
79. Effect of the sintering atmosphere 278

XI. Sintering of multicomponent systems

80. General comments 280
81. The case of mutual insolubility of components 281
82. Systems with mutual solubility of components Preliminary comments 284
83. Systems with mutual solubility of components 286
84. Sintering of multicomponent systems with formation of the liquid phase 291
85. Activated sintering without formation of the liquid phase 298

XII. Hot pressing

86. Basic information 301

XIII. Properties of sintered powder metals

87. Properties of porous metals 305
88. Properties of compact sintered metals and alloys 312

XIV. Significance of powder metallography

89. General comments 316
90. Powder metallography and the study of deformation and strength 316

CONFIDENTIAL

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8

CONFIDENTIAL

[redacted] 50X1-HUM

Page

91. Changes in intergranular contact of compact metals 319

92. Admixtures in cast metals 322

93. Powder metallography and problems of crystallization of molten metals 324

- E N D -

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/08/17 : CIA-RDP80-00809A000600340023-8